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**(56) Documents cited**

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UK CL (Edition J) A5R REY, F2K K4B4  
INT CL<sup>4</sup> A61B

**(54) Workpiece holding or positioning means**

(57) A surgical retractor assembly comprises a rail (1) in the form of a ring which is adjustably supported by legs (4) above the patient from the operating table. A carriage (7) is mounted on the rail and carries a retractor (14). The retractor is mounted on one end of a first arm (13) the other end of which is pivoted to the upper end of a second arm (12) the lower end of which carries a ball (11) which is mounted in a socket (9) in the carriage. The ball can be locked by a manually operated wedge (32) which also causes a rod (47) extending up a bore in the second arm to lock the pivot between the first and second arms. Operation of the wedge also locks the carriage in position on the rail. Thus, the retractor can be positioned as desired and then a single simple operation causes the wedge to hold the retractor in this position.

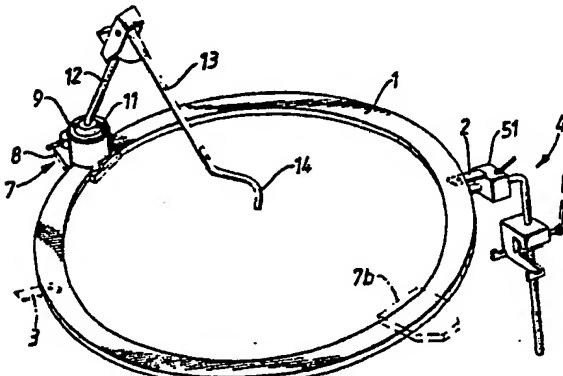


Fig.1.

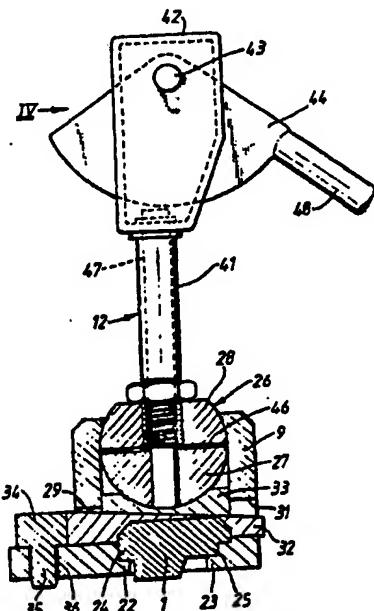


Fig. 3.

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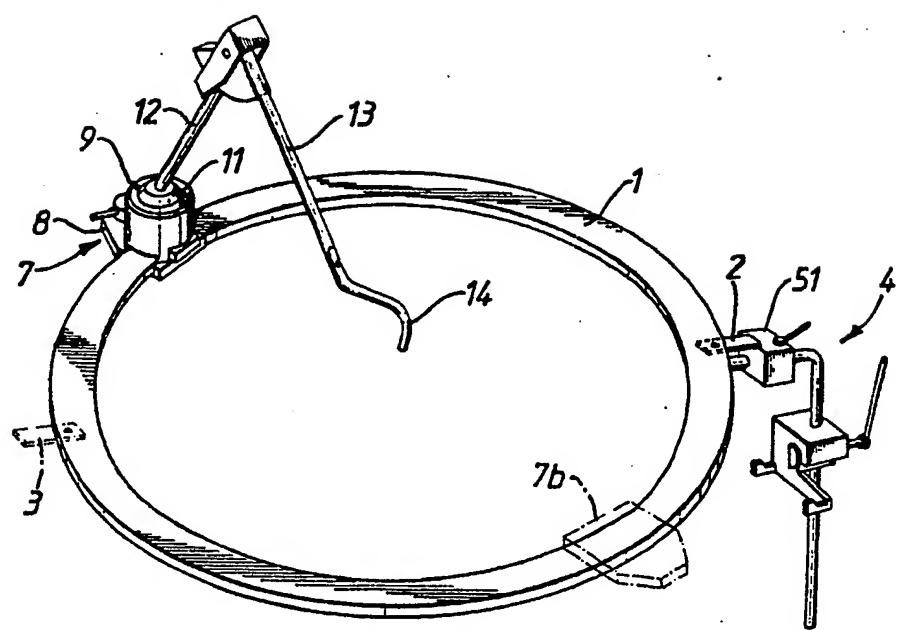


Fig.1.

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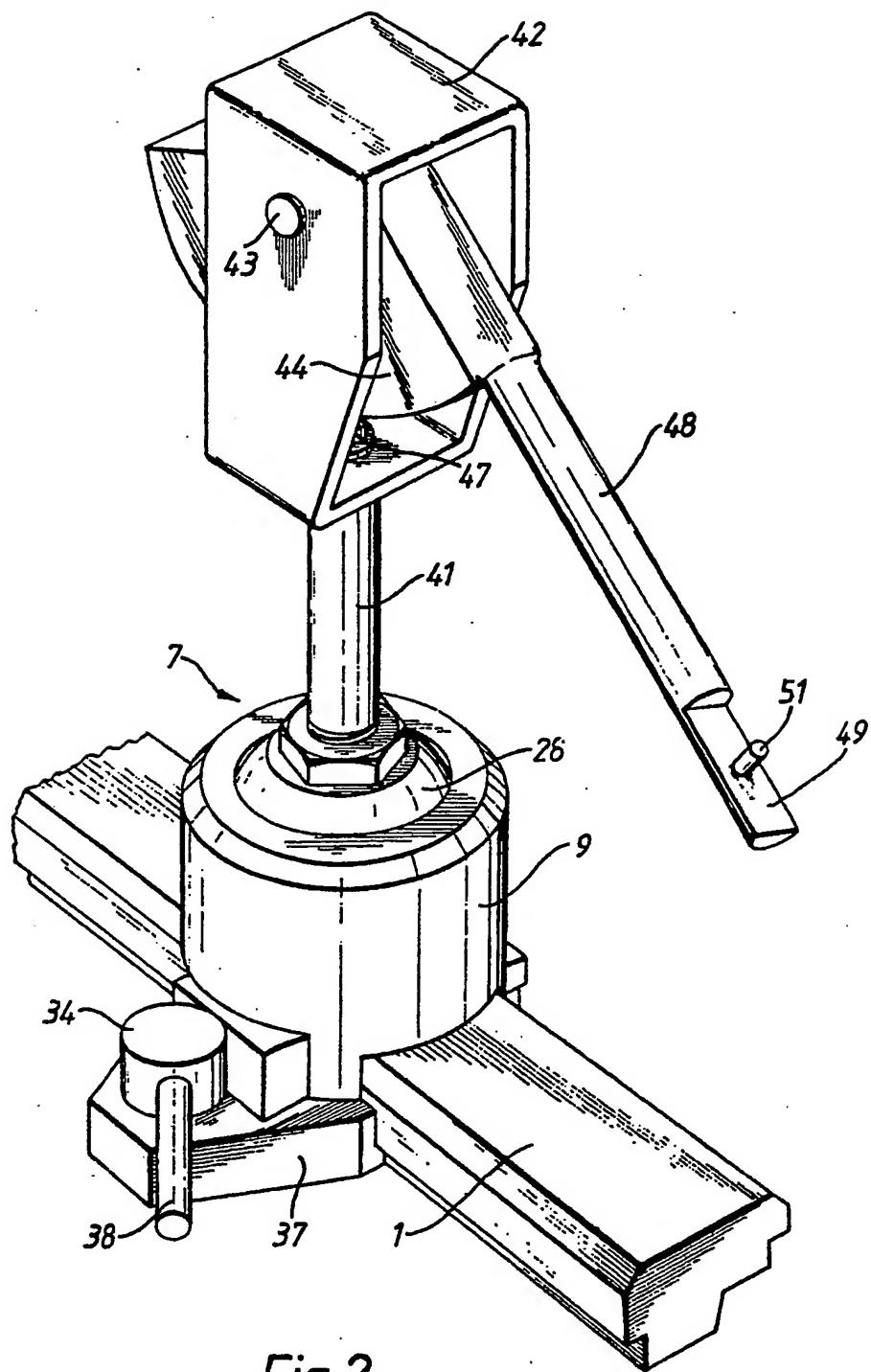


Fig. 2.

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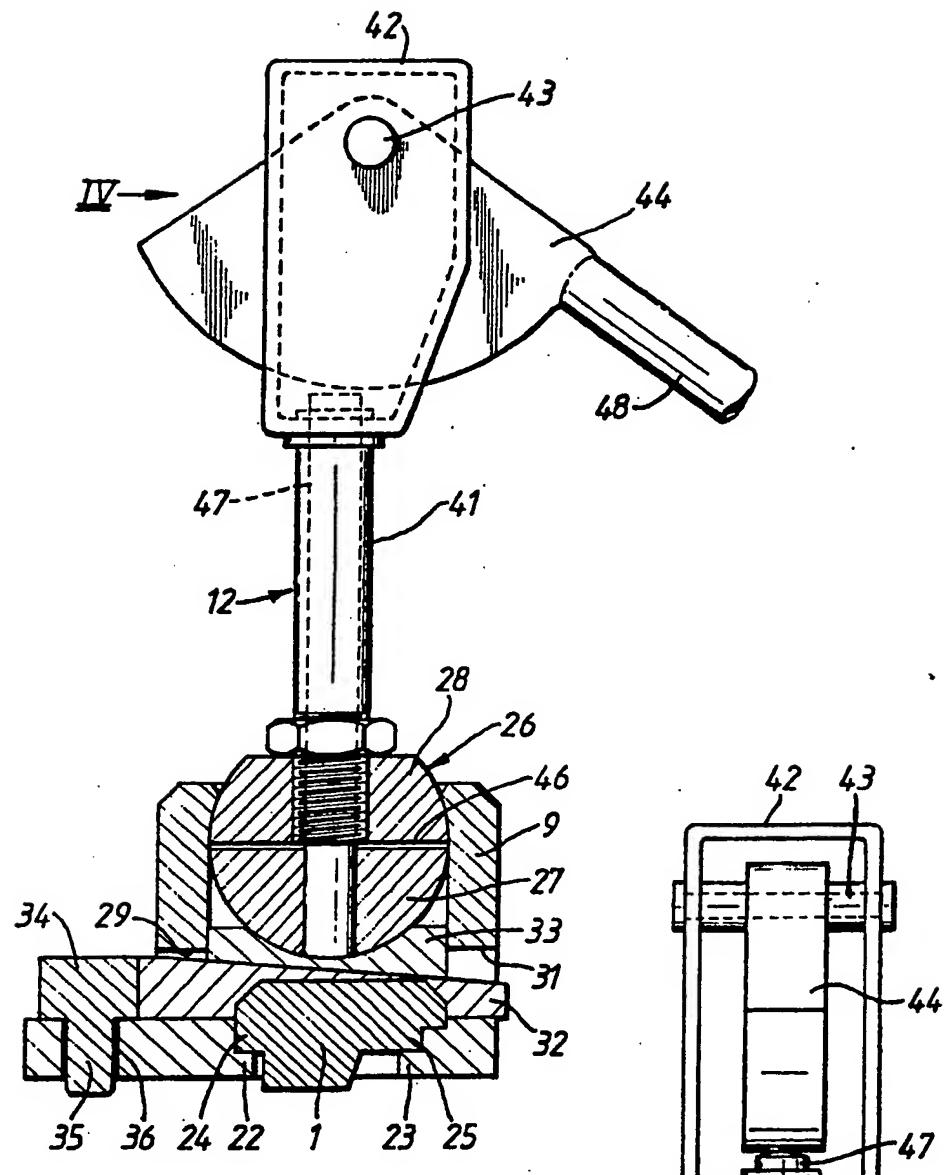


Fig. 3.

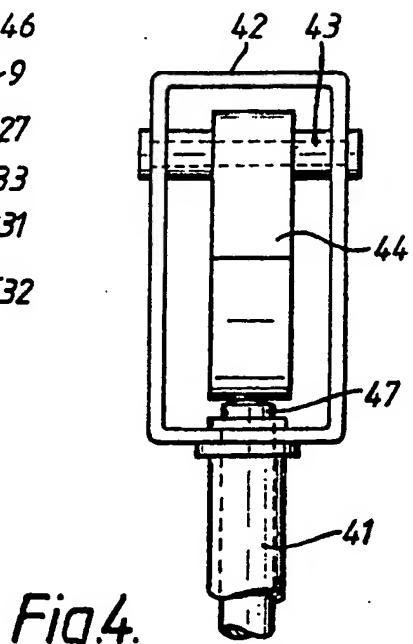


Fig.4.

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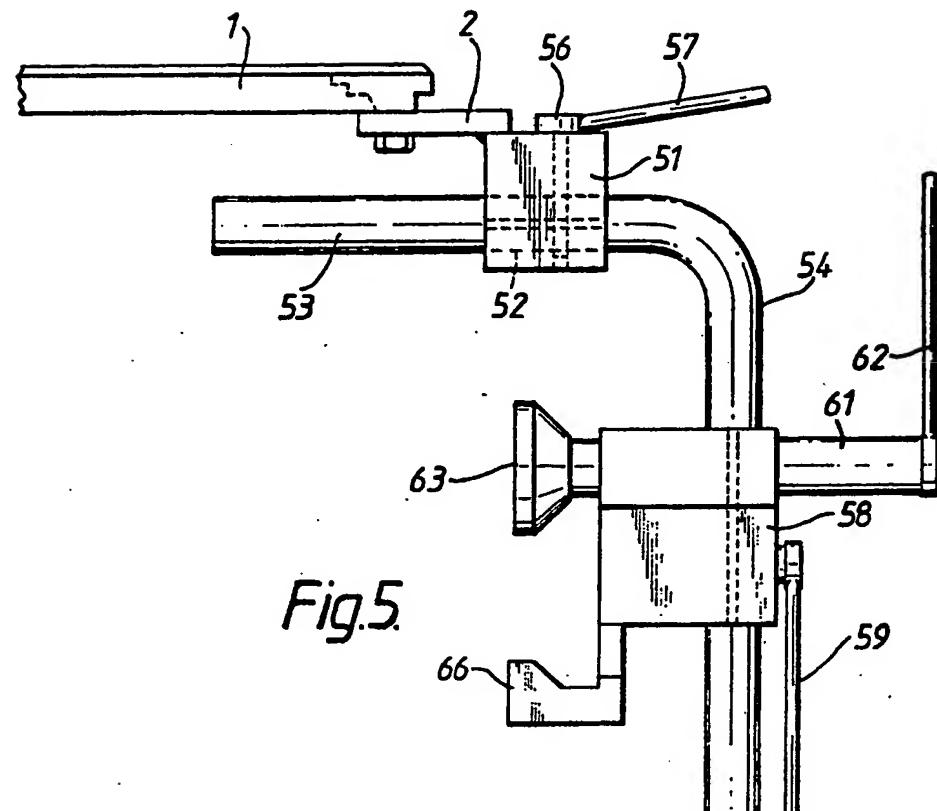


Fig.5.

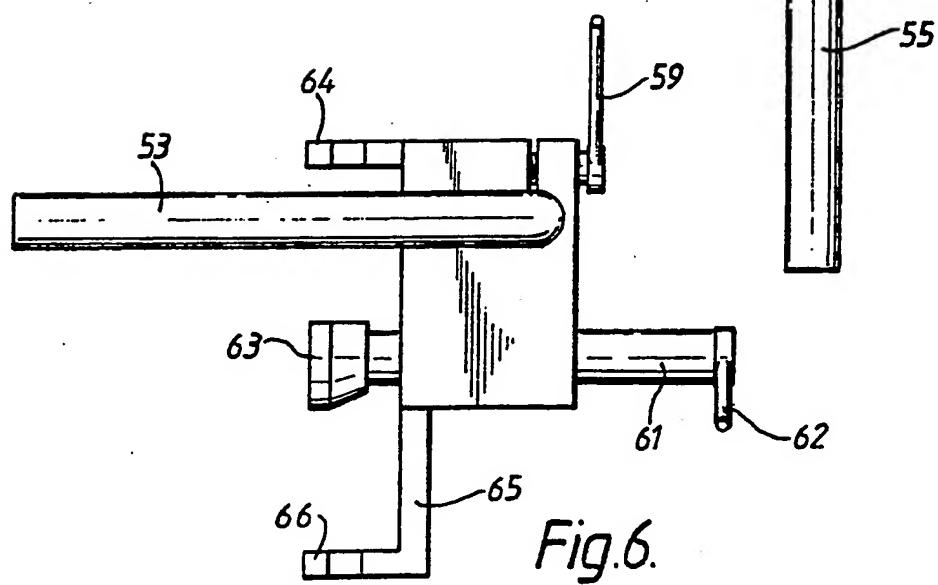
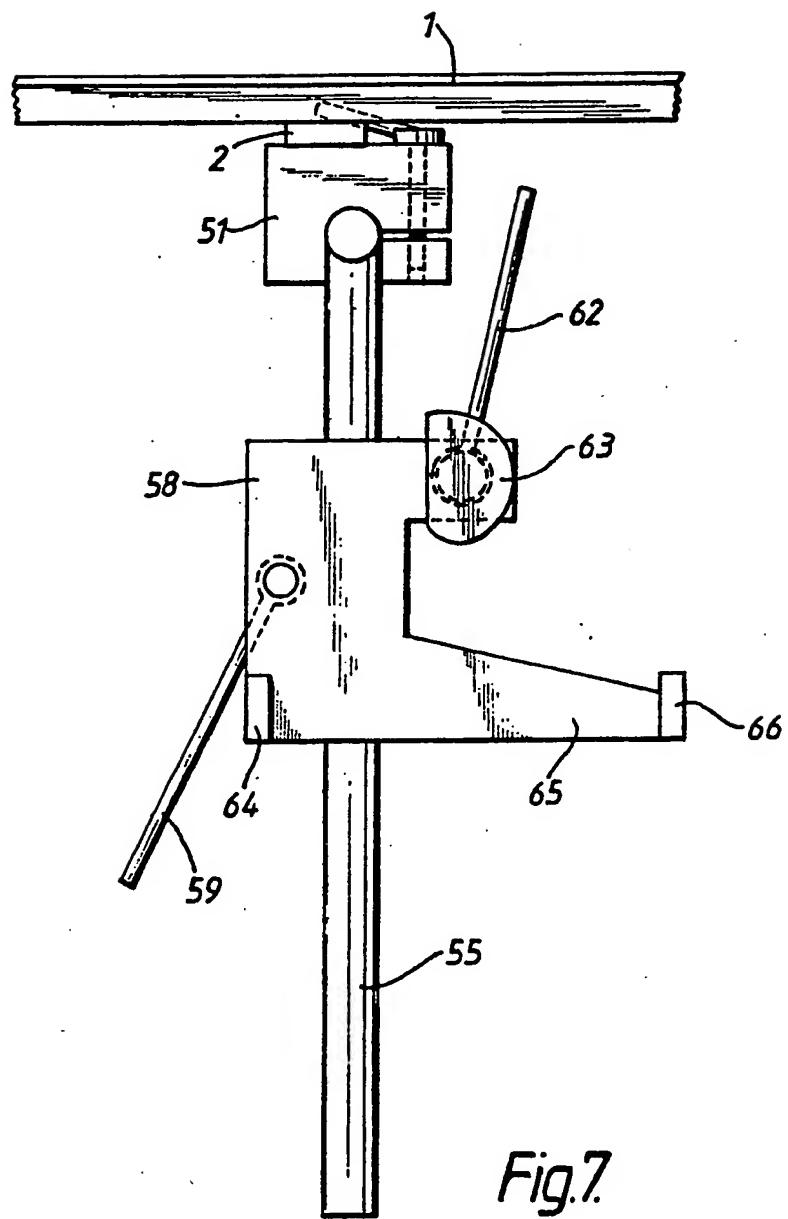


Fig. 6.

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1                   Workpiece Holding or Positioning Means

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3                   This invention relates to means for positioning or  
4                   holding a workpiece and the term work piece is intended  
5                   to be understood broadly since the invention is  
6                   particularly applicable to retractors for use in  
7                   surgical procedures. It will be understood that in  
8                   this case the workpiece is a part of the body of the  
9                   patient. Although the invention is primarily concerned  
10                   with retractors it will become apparent that the  
11                   invention provides means which may be used in other  
12                   fields, for example to hold an inanimate workpiece  
13                   while operations are performed on it.

14                   According to usual operating theatre procedures  
15                   suitably shaped retractors are held by hand, inserted  
16                   into an incision and pulled in an appropriate direction  
17                   to create an opening of sufficient size to enable a  
18                   surgeon to operate. In any but the simplest and  
19                   shortest operations this method quickly causes fatigue  
20                   to the assistants holding the retractors with  
21                   consequent loss of positional precision causing  
22                   difficulties to the surgeon and, in long operations,  
23                   requiring additional assistance. This situation can be  
24                   much improved by the use of retractor assemblies which,  
25                   once positioned, will remain in place as long as  
26                   required by the surgeon. Examples of such assemblies  
27                   exist but they have substantial disadvantages and in  
28                   general they are complicated, cumbersome and difficult  
29                   to use and take a considerable time to set up.

30                   According to one aspect of the present invention,  
31                   a surgical retractor assembly comprises a rail, a  
32                   carriage movable along the rail, a retractor attached  
33                   to the carriage by means permitting pivotal and/or

1    rotational movement of the retractor relative to the  
2    carriage, and a wedge arranged to simultaneously lock  
3    the carriage to the rail and the relative movement of  
4    the retractor.

5    According to a second aspect of the present  
6    invention a clamp assembly comprises a body forming a  
7    ball socket, a ball in the socket carrying a shaft the  
8    upper end of which carries a member connected to the  
9    shaft by a pivot having a pivot axis generally  
10   transverse to the longitudinal axis of the shaft, a  
11   wedge arranged to lock the ball in the socket, and  
12   locking means interconnecting the pivot and the ball  
13   and arranged to lock the pivot when the ball is locked.

14   According to a third aspect of the invention, a  
15   clamp assembly comprises a body forming a ball socket,  
16   a part-spherical ball element in the socket and  
17   carrying a first arm section, a second arm section  
18   connected to the outer end of the first section by a  
19   pivot, a rod extending generally parallel with the  
20   first arm section and having one end engaging the  
21   second arm section and having the other end operatively  
22   engaging one side of a wedge the other side of which is  
23   in operative engagement, with the socket, movement of  
24   the wedge in one direction tightening the ball element  
25   against the socket, pressing the rod against the second  
26   arm section, and tensioning the first arm section to  
27   render the assembly rigid.

28   The invention may be carried into practice in  
29   various ways but one form of retractor assembly  
30   embodying the present invention will now be described  
31   by way of example with reference to the accompanying  
32   drawings in which:

33        Figure 1 is a simplified perspective view of the

1 complete assembly;

2 Figure 2 is an isometric view of a clamp for a  
3 single retractor mounted on the ring of the assembly;

4 Figure 3 is a vertical or axial section through  
5 the clamp shown in Figure 2;

6 Figure 4 is a fragmentary elevation seen in the  
7 direction of the arrow IV in Figure 3 of the upper part  
8 of the clamp;

9 Figure 5 is a front elevation to a larger scale of  
10 the means of support of the assembly shown in Figure 1;

11 Figure 6 is a plan view of the means of support  
12 shown in Figure 5 but with parts omitted, and

13 Figure 7 is a side elevation of the means of  
14 support shown in Figures 5 and 6.

15 The assembly shown in Figure 1 comprises a rigid  
16 ring 1 whose cross section can be seen from Figures 2  
17 and 3, the ring being provided with a radially  
18 extending arm 2 which is provided with support means 4,  
19 to be described later, for attachment to one of the  
20 rails which run lengthwise along the sides of standard  
21 operating tables. The ring 1 can thus be positioned  
22 above the site of the intended incision in the patient  
23 and although it will usually lie in a horizontal plane  
24 the support means 4 provides for rotation of the ring  
25 about the longitudinal axes of the arm 2 so that it can  
26 be tilted to be higher towards the head end than the  
27 foot end of the patient or vice versa. A second  
28 radially extending arm 3 and a further support means  
29 may, if desired, be provided on the other side of the  
30 table.

31 Mounted on the ring 1 is a plurality of clamps 7  
32 only one of which is shown but the position of an  
33 additional one of which is indicated by dotted lines

1      7b. Broadly speaking the clamp 7 comprises a body 8  
2      which is slidable along the ring 1, a socket portion 9  
3      extending upwardly from the base 8 and containing a  
4      ball assembly 11, a first arm 12 moving with the ball  
5      and a second arm 13 pivoted to the upper end of the arm  
6      12. A retractor blade 14 is attached to the outer end  
7      of the arm 13.

8      Attention is now directed to Figures 2, 3 and 4  
9      which show the clamp in greater detail. The socket  
10     portion 9 of the clamp 7 is generally cylindrical and  
11     the lower portion thereof is shaped to provide an  
12     opening or groove to receive the ring 1, the edges of  
13     the opening being formed as inwardly directed flanges  
14     22,23 to engage underneath the flanges 24,25 which  
15     project from the upper parts of the outer and inner  
16     sides of the ring 1 respectively. At the upper end of  
17     the bore of the cylindrical portion 9 the inner surface  
18     curves inwardly to provide a part-spherical inner  
19     surface to engage a part of the surface of a ball  
20     assembly 26 consisting of a lower hemispherical portion  
21     27 and an upper truncated hemispherical portion 28. In  
22     the lower part of the cylindrical wall 9 there are two  
23     diametrically opposite openings 29,31 through which a  
24     wedge member 32 passes beneath the ball assembly 26 and  
25     above the ring 1. A seat member 33 is interposed  
26     between the ball assembly 26 and the wedge 32, the  
27     upper surface of the seat member 33 having a  
28     part-spherical depression corresponding to the surface  
29     of the ball assembly 26 and the lower surface being  
30     inclined in the direction which is complementary to the  
31     upper surface of the wedge 32. As will be explained  
32     below, when the wedge member 32 is moved to the right  
33     the whole clamp assembly is locked up tightly, the

1 lower side of the wedge member 32 pressing against the  
2 upper surface of the ring 1 which in turn presses on  
3 the flanges 22,23 of the body of the clamp member and  
4 the upper surface of the wedge member 32 pressing  
5 through the seat member 33 against the ball assembly 26  
6 which in turn is pressed against the inwardly curved  
7 upper part of the bore in the cylindrical part 9 of the  
8 clamp member.

9 Means are provided for moving the wedge member 32  
10 to the right as seen in Figure 3, such means comprising  
11 a cam or eccentric 34 which carries an off-centre pivot  
12 pin 35 carried in a bore 36 in a bracket portion 37  
13 integral with and projecting laterally from the lower  
14 part of the cylindrical portion 9. The cam carries a  
15 radially extending handle 38 by which it may  
16 conveniently be rotated. The geometry of the cam 34  
17 and the wedge member 32 and the coefficients of  
18 friction between the surfaces of these members and the  
19 surfaces with which they react are so selected that the  
20 wedge is effectively self-locking and once it is moved  
21 into a locking position it will not become free without  
22 deliberate rotation of the handle 38.

23 Rigid with the upper hemispherical member 28 of  
24 the ball assembly 26 is an outer sleeve 41 carrying at  
25 its upper end a yoke 42 between the arms of which there  
26 extends a shaft 43 forming a pivot with an axis  
27 transverse to that of the sleeve 41 and mounting a  
28 quadrant plate 44 to which is fixed a rod 48 which  
29 constitutes the outer arm 13 shown in Figure 1. As can  
30 be seen in Figure 2 the outer end of the rod 48 has a  
31 cut-out 49 from which projects a locating pin 51. A  
32 retractor blade having a shaft including a cut-out  
33 complementary to the cut-out 49 and a hole to receive

1 the pin 51 is attached to the rod 48 and is secured in  
2 position by a sleeve which slides along the rod 48.

3 A rod 47 slides within the sleeve 41 and the rod  
4 47 and the sleeve 41 together constitute the arm 12  
5 shown in Figure 1. The lower end of the rod 47 is  
6 fixed in a bore in the lower hemispherical portion 27  
7 of the ball assembly while the upper end of the rod 47  
8 is rounded and engages the arcuate surface of the  
9 quadrant plate 44. The length of the rod 47 is such  
10 that there is always a small gap 46 (Figure 3) between  
11 the upper and lower hemispherical portions of the ball  
12 assembly.

13 The described apparatus is used as follows. The  
14 ring 1 is set up over the site of the incision as will  
15 be described and the incision made. A clamp 7 is then  
16 placed on the ring, the clearances between the body of  
17 the clamp and the ring 1 being such as to permit  
18 positioning of the clamp on the ring by appropriate  
19 manipulation. The retractor 14 is then positioned by  
20 the surgeon as required and is then locked in place by  
21 operation of the handle 38 thus moving the wedge 32  
22 inwards and locking the assembly. Inward movement of  
23 the wedge 32 raises the lower hemispherical portion 27  
24 of the ball assembly, thus forcing the upper end of the  
25 rod 47 hard against the quadrant plate 44 to lock  
26 frictionally the quadrant plate and hence the rod 48  
27 and the retractor in position. The reaction from the  
28 engagement of the upper end of the rod 47 against the  
29 quadrant plate 44 is taken through the shaft 43 the  
30 yoke 42 and the sleeve 47 to the upper hemispherical  
31 portion 28 which is pressed against the inturned upper  
32 end of the socket portion 9 to clamp the socket  
33 assembly tightly in place. Thus, the ball assembly is

1 unable to mov through any of its degrees of freedom.  
2 The sleeve 41 is unable to rotate so that the yoke 42  
3 and in turn the rod 48 are unable to rotate about the  
4 longitudinal axis of the sleeve 41. Accordingly, the  
5 position of the retractor is fixed and will not change  
6 until the cam 34 is moved to the release position and  
7 the wedge 32 is moved back.

8 It will be appreciated that retractor blades of  
9 various constructions and shapes can be attached to the  
10 rod 48 to suit the immediate requirements of the  
11 surgeon. One particular advantage to be obtained by  
12 use of the apparatus is that the retractor can be used  
13 to apply upward force to the flap of the patient  
14 revealed by the incision as compared with the earlier  
15 mechanical retractors by use of which it is difficult  
16 to apply anything other than a horizontal force.

17 The support means 4 shown in Figure 1 will now be  
18 described in greater detail with reference to Figures  
19 5, 6 and 7. As previously mentioned, the ring 1  
20 carries a radially extending arm 2 which may be  
21 connected to support means 4. The arm 2 is welded to a  
22 block 51 formed with a bore 52 which, when the  
23 apparatus is in its operative position, extends  
24 generally horizontally and radially of the ring 1. The  
25 bore 52 receives the return portion 53 of a rod 54  
26 which is generally of inverted L-shape and the vertical  
27 limb 55 of which provides a support column for the  
28 apparatus. The block 51 is formed with a horizontal  
29 split extending from one side to the bore in a plane  
30 containing the axis of the bore and the two sides of  
31 the bore are connected by a clamping screw 56 which is  
32 freely rotatable in a vertical bore in the part of the  
33 block 51 above the split and which extends into a

1      threaded bore in the part of the block below the split.  
2      The screw 56 carries a lever shaped handle 57 rotation  
3      of which in one direction causes the split to close so  
4      that the return portion 53 of the rod 54 is gripped  
5      tightly in the block 51.   In a similar manner the  
6      vertical limb 55 of the rod 54 passes through a  
7      vertical bore in a block 58 in which it can be clamped  
8      by means of a lever 59 closing a split in the block.  
9      The block 58 also has a horizontal bore through which  
10     extends a shaft 61 carrying an operating lever 62 at  
11     one end and a locking cam 63 at the other end.   At one  
12     lower corner of the block 58 there is a hook 64 which  
13     extends away from the block radially inwardly of the  
14     ring 1 and has a return portion turning upwards.   From  
15     an adjacent corner there is a horizontally extending  
16     arm 65 which carries at its distal end a hook 66  
17     similarly arranged to the hook 64.

18     The ring 1 is set up as follows.   With the rod 54  
19     loosely positioned in the block 58 the hooks 64,66 are  
20     positioned under the longitudinal rail extending along  
21     one side of the operating table with the cam 63  
22     positioned above the rail and the lever 62 is then  
23     rotated to cause the locking cam 63 to grip the rail  
24     between the cam and the hooks 64 and 66 so that the  
25     block 58 is rigidly secured to the rail.   The height of  
26     the ring is then adjusted by moving the rod 54 up and  
27     down in the vertical bore in the block 58 and it is  
28     then locked in position by rotation of the lever 59.  
29     The lateral position of the ring can then be adjusted  
30     by sliding the block 51 along the return portion 53 of  
31     the rod 54 and when it is in position it can be clamped  
32     by operation of the lever 57.

33     It will be noted that the various locking

1 operations are effected by rotation of easily  
2 manipulated levers and the device can be set up in a  
3 very short time indeed.

4 Although the invention has been described in  
5 relation to a retractor for surgical operations the  
6 mechanism described can be used in other environments  
7 where there is a requirement to lock a tool or  
8 workpiece in a position in space. For example, in  
9 place of the retractor blade 14 the arm 13 could carry  
10 a chuck or holder to carry a workpiece to be operated  
11 on or a specimen to be examined.

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## 1   Claims:

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3   1. A surgical retractor assembly comprising a rail, a  
4   carriage movable along the rail, a retractor attached  
5   to the carriage by means permitting pivotal and/or  
6   rotational movement of the retractor relative to the  
7   carriage, and a wedge arranged to simultaneously lock  
8   the carriage to the rail and the relative movement of  
9   the retractor.

10

11   2. An assembly as claimed in claim 1 in which the  
12   rail is circular.

13

14   3. An assembly as claimed in claim 1 or claim 2 or  
15   which includes means for supporting the rail from an  
16   operating table.

17

18   4. An assembly as claimed in claim 1 or claim 2 or  
19   claim 3 in which the retractor includes a pivot  
20   separate from the attaching means, the said pivot being  
21   also locked by the wedge.

22

23   5. A retractor assembly substantially as described  
24   herein with reference to the accompanying drawings.

25

26   6. A clamp assembly comprising a body forming a ball  
27   socket, a ball in the socket carrying a shaft the upper  
28   end of which carries a member connected to the shaft by  
29   a pivot having a pivot axis generally transverse to the  
30   longitudinal axis of the shaft; a wedge arranged to  
31   lock the ball in the socket, and locking means  
32   interconnecting the wedge and the pivot and arranged to  
33   lock the pivot when the ball is locked.

1    7. An assembly as claimed in claim 6 in which the  
2    ball comprises a first portion to which the shaft is  
3    fixed and a second portion carrying a sleeve through  
4    which the shaft passes, the said member being pivoted  
5    to the sleeve and hence to the shaft.

6

7    8. An assembly as claimed in claim 7 in which the  
8    said member carries a quadrant and the shaft engages  
9    the periphery of the quadrant to lock the pivot.

10

11    9. An assembly as claimed in claim 8 in which the  
12    sleeve carries a yoke in which the quadrant is pivoted,  
13    the shaft engaging the quadrant within the yoke.

14

15    10. An assembly as claimed in any of claims 6 to 9 in  
16    which the member comprises an arm carrying a surgical  
17    retractor at its outer end.

18

19    11. An assembly as claimed in any of the preceding  
20    claims in combination with a rail on which the assembly  
21    is clampably movable.

22

23    12. An assembly as claimed in claim 11 in which the  
24    assembly is clampable on the rail by the wedge.

25

26    13. An assembly as claimed in any of claims 6 to 12  
27    which includes a cam or eccentric mounted on the socket  
28    and arranged to translate the wedge to its locking  
29    position.

30

31    14. An assembly as claimed in claim 13 which includes  
32    a handle for manual rotation of the cam or eccentric.

33

1 15. A clamp assembly comprising a body forming a ball  
2 socket, a part-spherical ball element in the socket and  
3 carrying a first arm section, a second arm section  
4 connected to the outer end of the first section by a  
5 pivot, a rod extending generally parallel with the  
6 first arm section and having one end engaging the  
7 second arm section and having the other end operatively  
8 engaging one side of a wedge the other side of which is  
9 in operative engagement with the socket, movement of  
10 the wedge in one direction tightening the ball element  
11 against the socket, pressing the rod against the second  
12 arm section, and tensioning the first arm section to  
13 render the assembly rigid.

14

15 16. A clamp assembly substantially as described herein  
16 with reference to Figures 2 to 4 of the accompanying  
17 drawings.

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